

Fig. 1

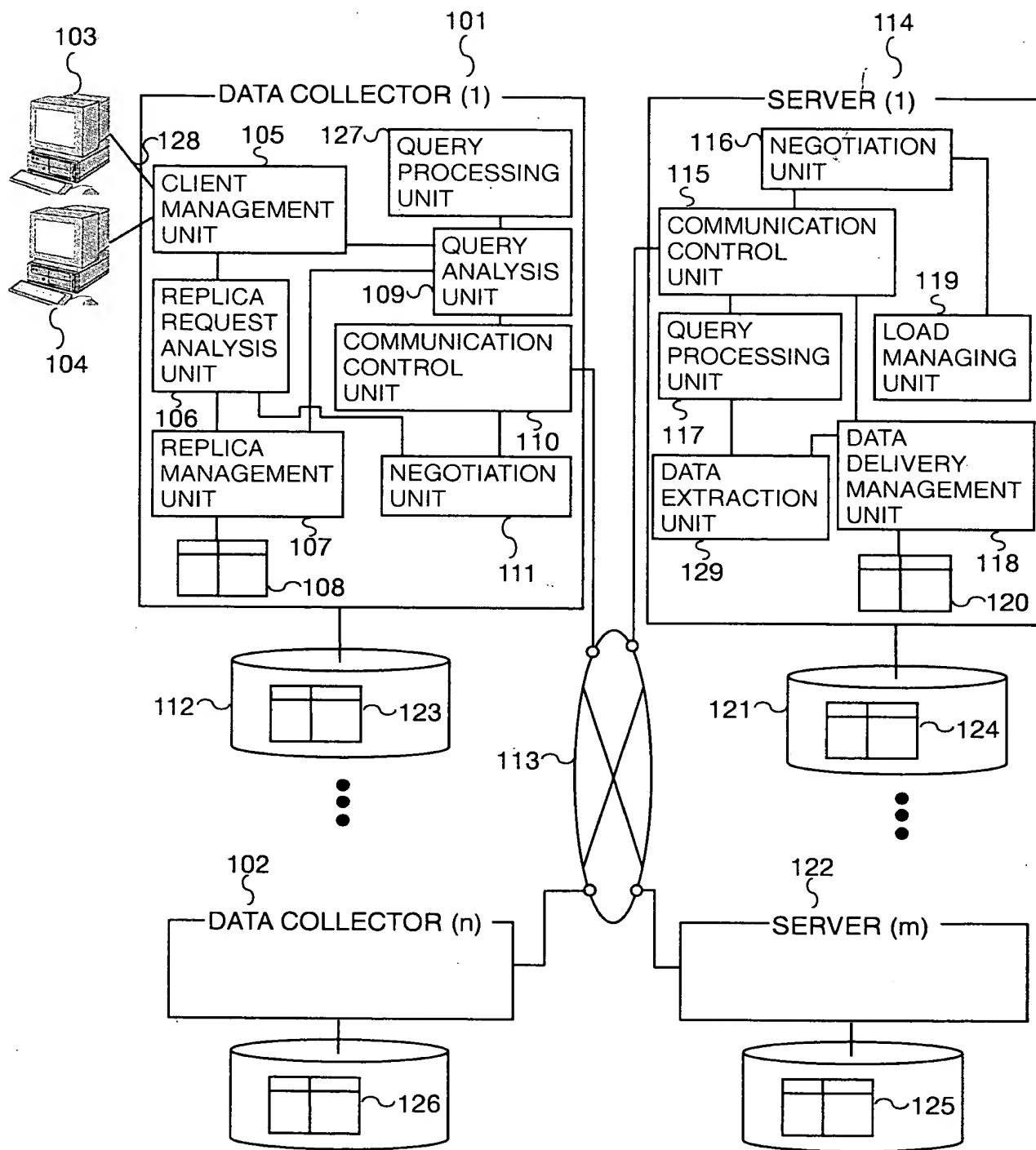


Fig. 2

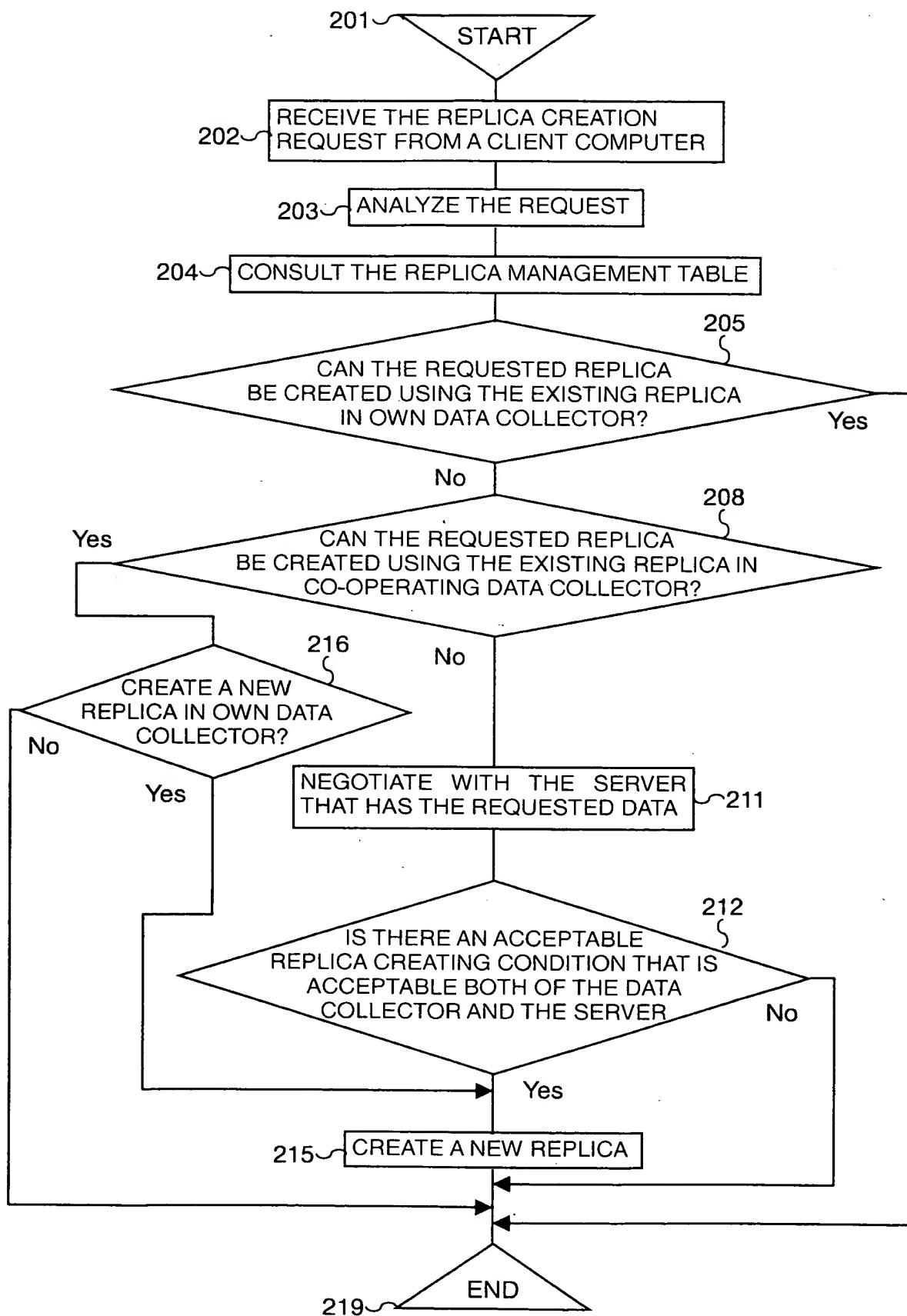


Fig. 3

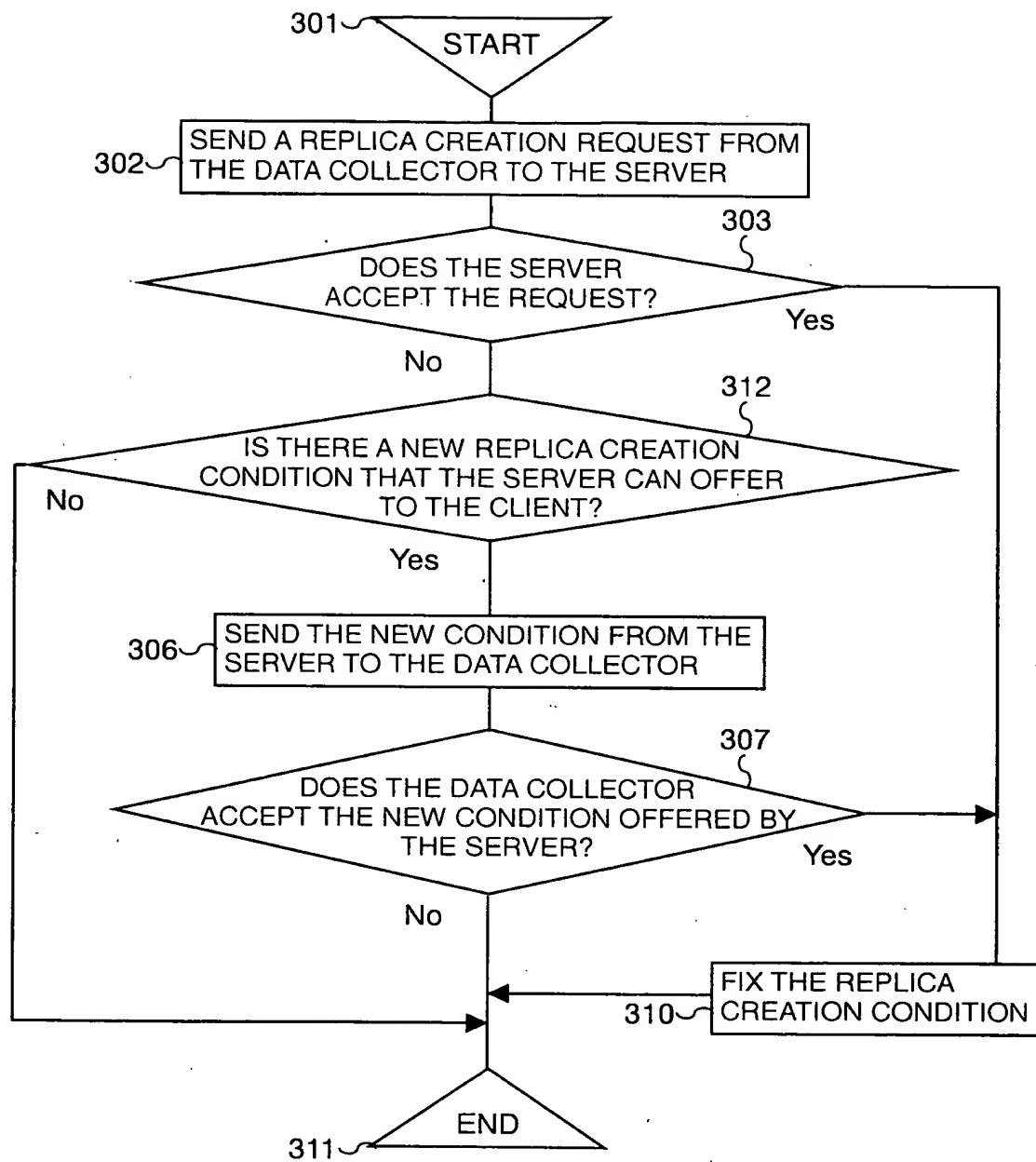


Fig. 4

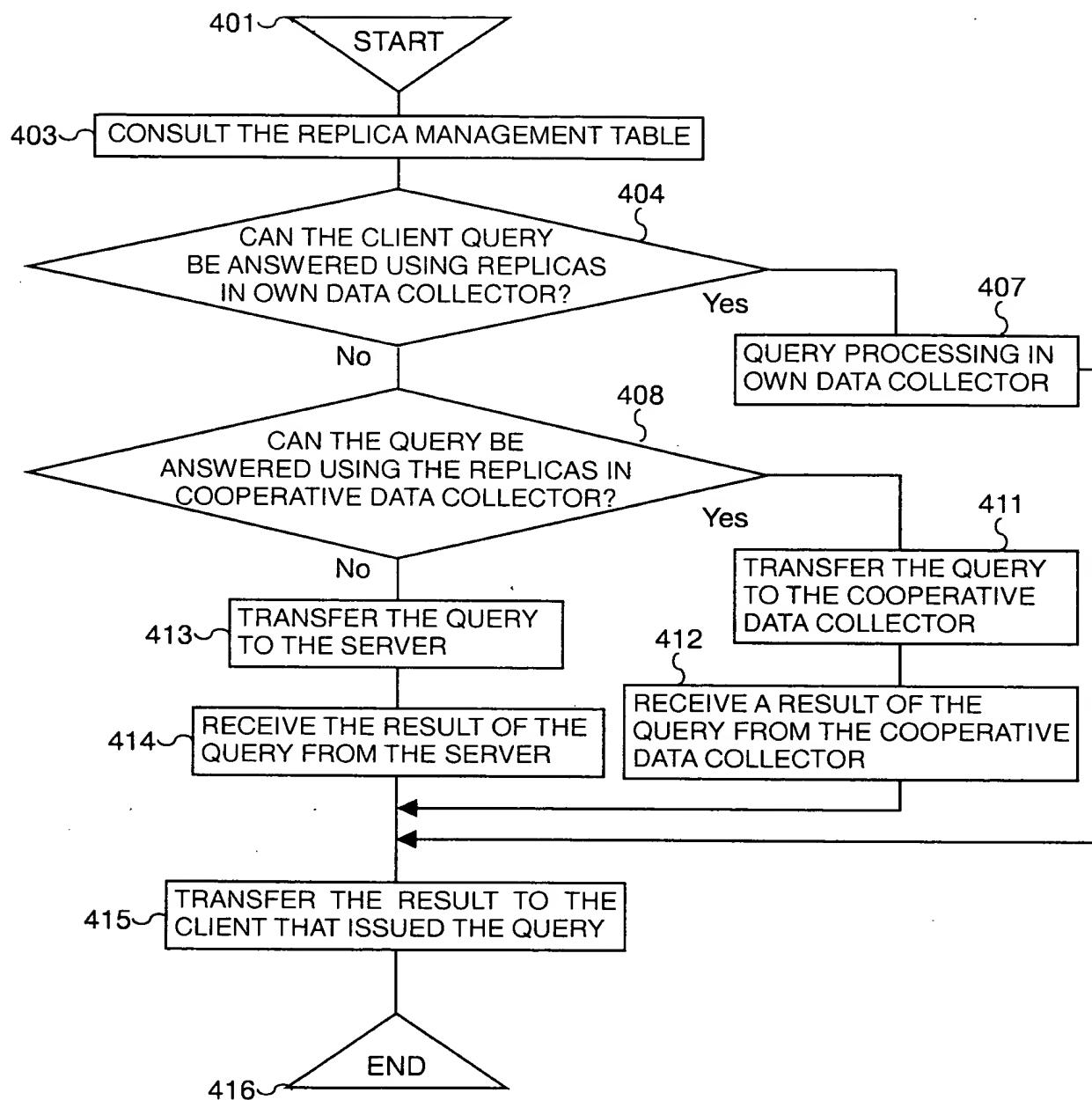


Fig. 5

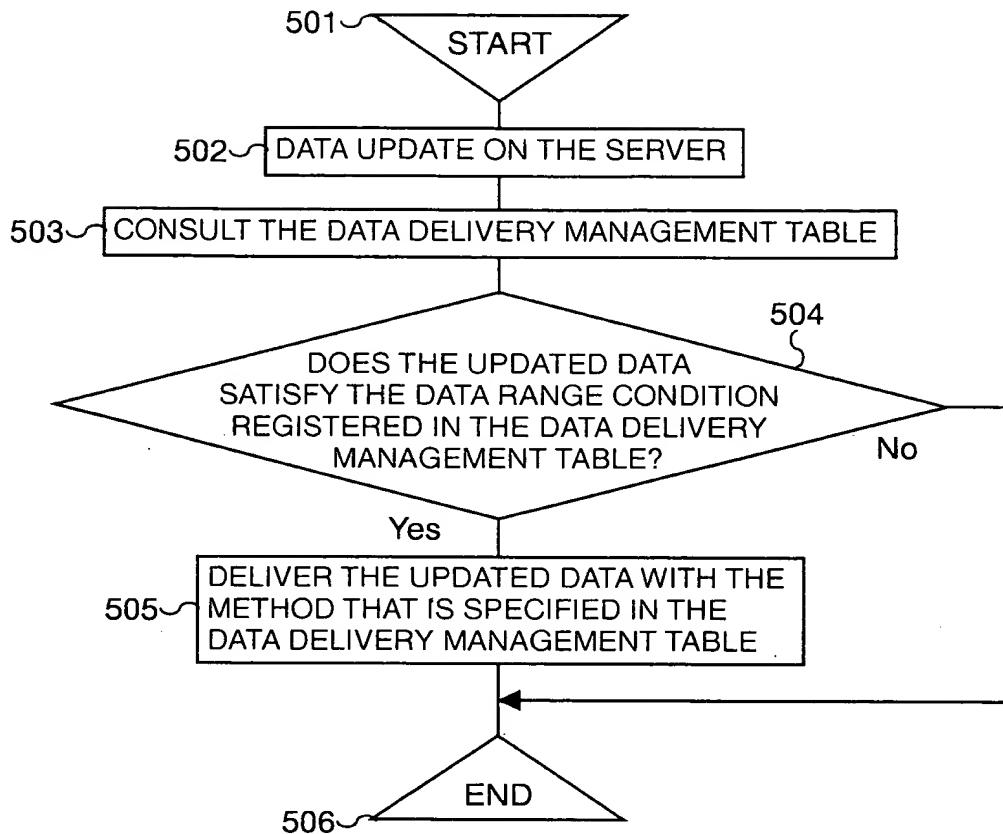


Fig. 6

REPLICA CREATION REQUEST

601 DATA RANGE	603 DATA QUALITY	604 DELIVERY METHOD
ORDER(ORDER_ID, PRICE, CUSTOMER_ID) PRICE>=10000		13:00, PUSH
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), 5000<=PRICE<=8000	FRESH(ORDER, 1 HOUR) 605	{1:00, 13:00}, PULL
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE<=2000	SAMPLE(ORDER, ORDER_ID, 10%) 606	ONCE BETWEEN 21:00 AND 23:00, PULL
SALESDETAIL(ORDER_ID, SHIPDATE, ORDER_AMOUNT), SHIPDATE>=1990/01/01	TOP-N(SALESDETAIL, ORDER_AMOUNT, 100) 607	ONCE PER 1 HOUR, PULL
...	...	...

*Fig. 7*

DATA TYPE	DATA QUALITY ADJUSTMENT METHOD
RELATIONAL DATABASE RECORD	RECORD SAMPLING, COLUMN PROJECTION
DOCUMENT	KEYWORD EXTRACTION, SUMMARY CREATION
IMAGE	IMAGE COMPRESSION, IMAGE FORMAT CONVERSION, EXTRACT OUTLINE, REDUCE THE NUMBER OF COLORS, REDUCE RESOLUTION, MAKE IMAGE SIZE SMALLER
MOVIE	REDUCE FRAME RATE, IMAGE COMPRESSION IN A FRAME
SOUND	CHANGE SAMPLING RATE, CONVERT TO CHARACTER INFORMATION

*Fig. 8*

REPLICA MANAGEMENT

REPLICA DESCRIPTION	DATA RANGE	DATA QUALITY	REPLICA LOCATION	SERVER LOCATION	DELIVERY METHOD
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE>=10000	803	801	DATA COLLECTOR (1)	SERVER (1)	13:00, PUSH
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE>=10000	802	807	DATA COLLECTOR (3)	SERVER (1)	{1:00, 13:00}, PULL
ORDER(ORDER_ID, PRICE), PRICE<=3000	804	808	DATA COLLECTOR (2)	SERVER (2)	12:00, PUSH
ORDER(ORDER_ID, PRICE), 3000<=PRICE<=5000	805	SAMPLE(ORDER, ORDER_ID, 10%)	DATA COLLECTOR (2)	SERVER (2)	ONCE PER 2 HOURS, PULL
	806				

Fig. 9

DELIVERY DATA MANAGEMENT TABLE

901	902	903	904	
DATA RANGE	DATA QUALITY	DELIVERY DESTINATION	DELIVERY METHOD	
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE>=10000	-	DATA COLLECTOR (1)	13:00, PUSH	~905
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE>=10000	-	DATA COLLECTOR (3)	{1:00, 13:00}, PUSH	~906
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE>=50000	TOP-N(ORDER, PRICE, 10)	DATA COLLECTOR (7)	ONCE PER 1 HOUR , PULL	
...	...			...

INSERT DATA

(ORDER\_ID, PRICE, CUSTOMER\_ID) = (10005, 12500, 256) ~907

Fig. 10

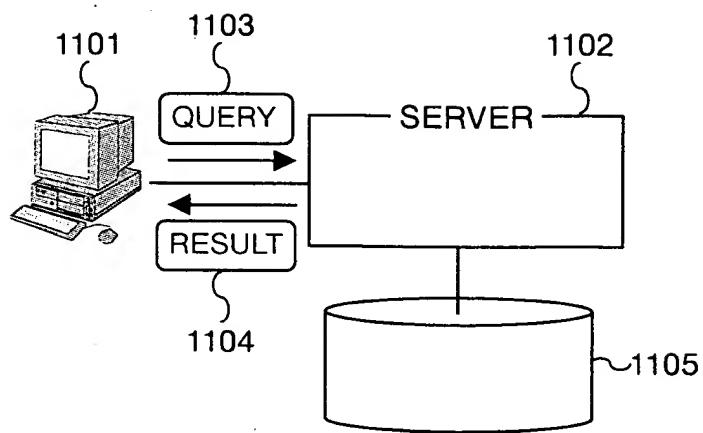
(A) DELIVERY CREATION REQUEST

DATA RANGE	DATA QUALITY	DELIVERY METHOD	
ORDER(ORDER_ID, PRICE, CUSTOMER_ID) PRICE>=10000	-	13:00, PUSH	~1001
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), 5000<=PRICE<=8000	FRESH(ORDER, 1 HOUR)	{1:00, 13:00}, PUSH	
SALESDetail(ORDER_ID, SHIPDATE, ORDER_AMOUNT), SHIPDATE>=1990/01/01	-	ONCE PER 1 HOUR, PULL	~1002
...	...	...	...

(B) SERVER REPLY

SERVER REPLY	DATA RANGE	DATA QUALITY	DELIVERY METHOD	
ACCEPT	-	-	13:00, PUSH	~1003
ACCEPT	-	-	{1:00, 13:00}, PUSH	
CONDITIONALLY ACCEPT	SALESDetail(ORDER_ID, SHIPDATE, ORDER_AMOUNT), SHIPDATE>=1994/01/01	-	ONCE PER 2 HOURS , PULL	~1004
...	...	...	...	...

*Fig. 11*



*Fig. 12*

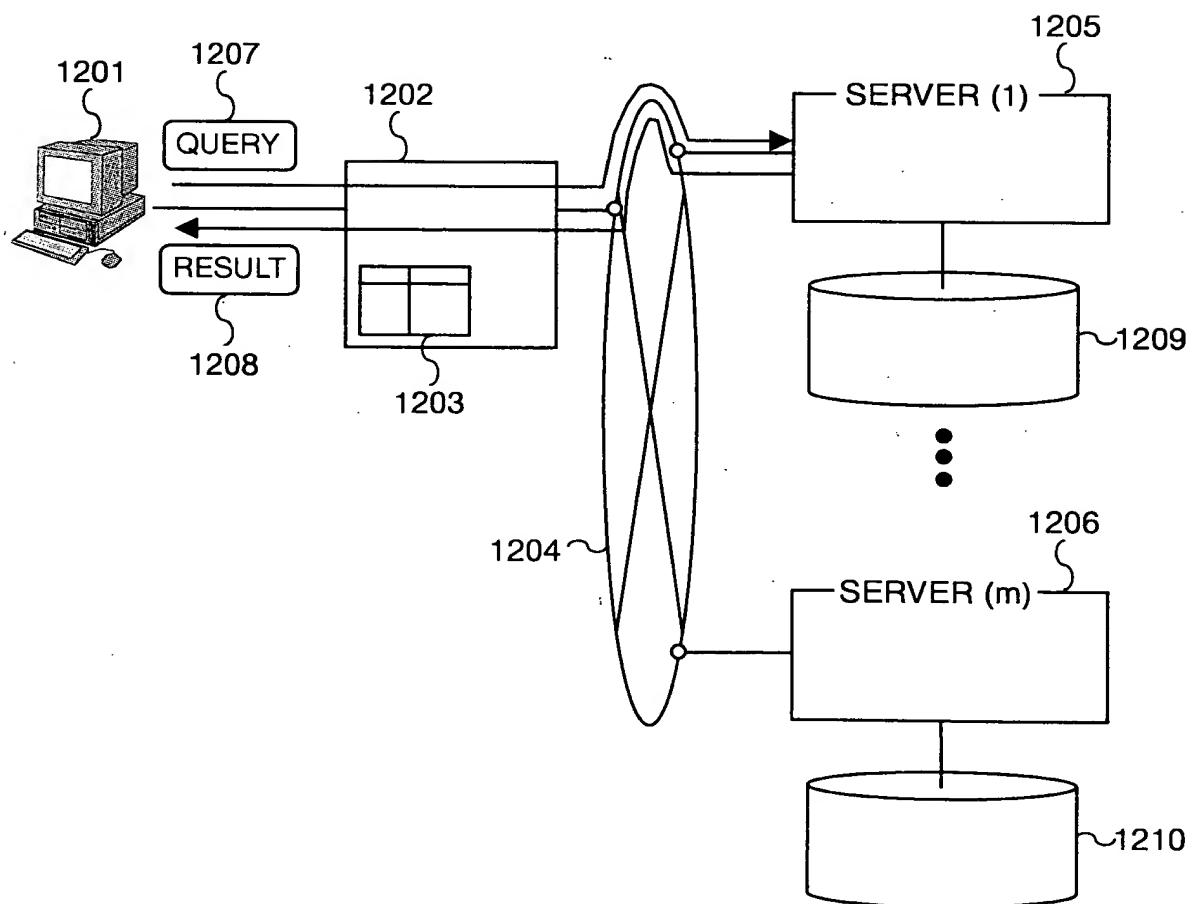


Fig. 13

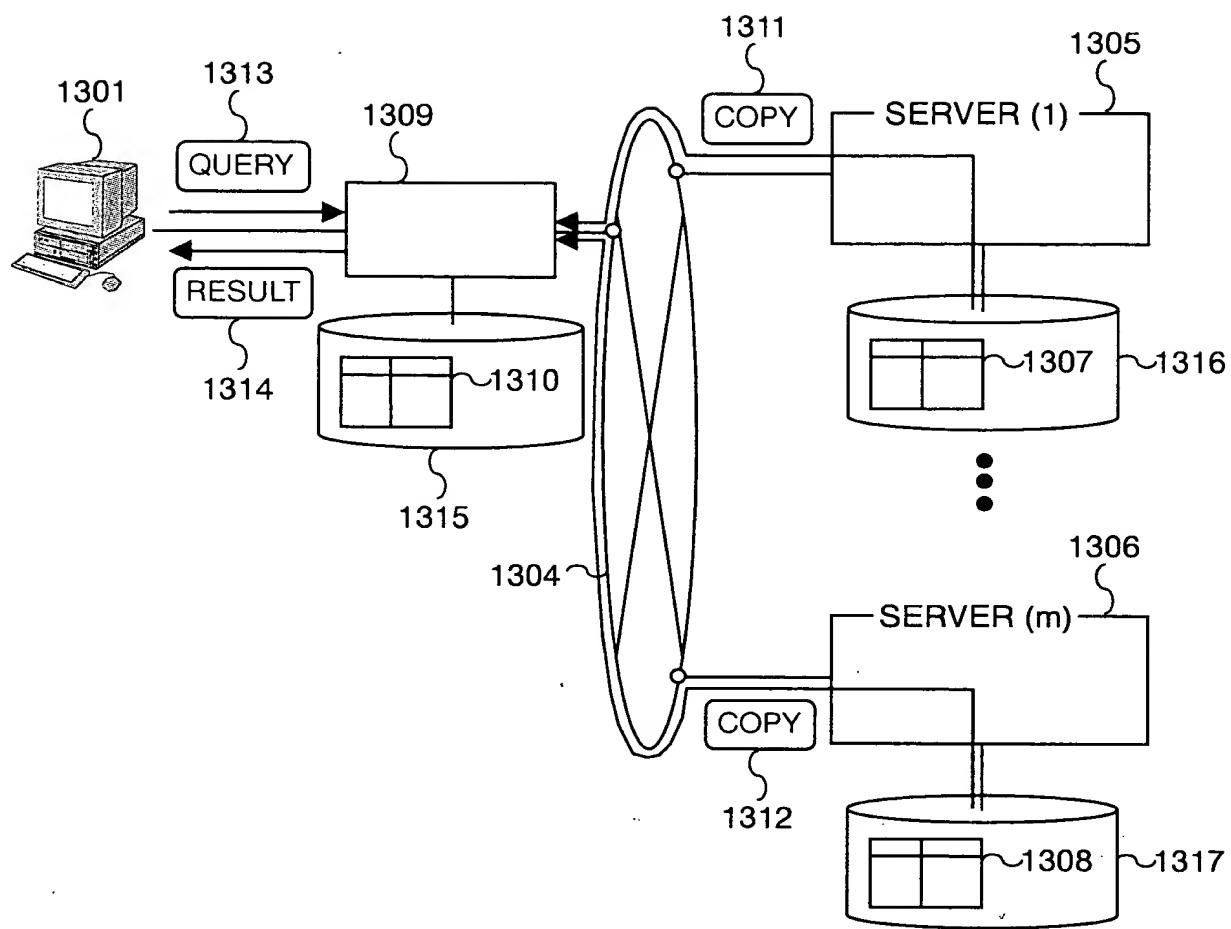


Fig. 14

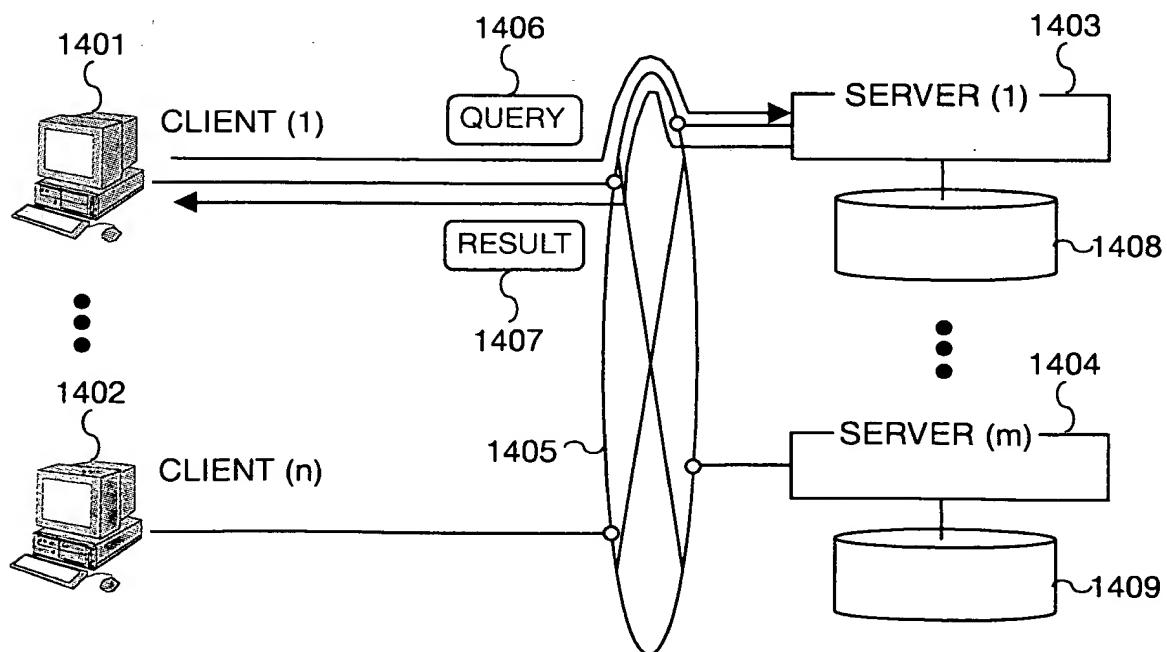


Fig. 15

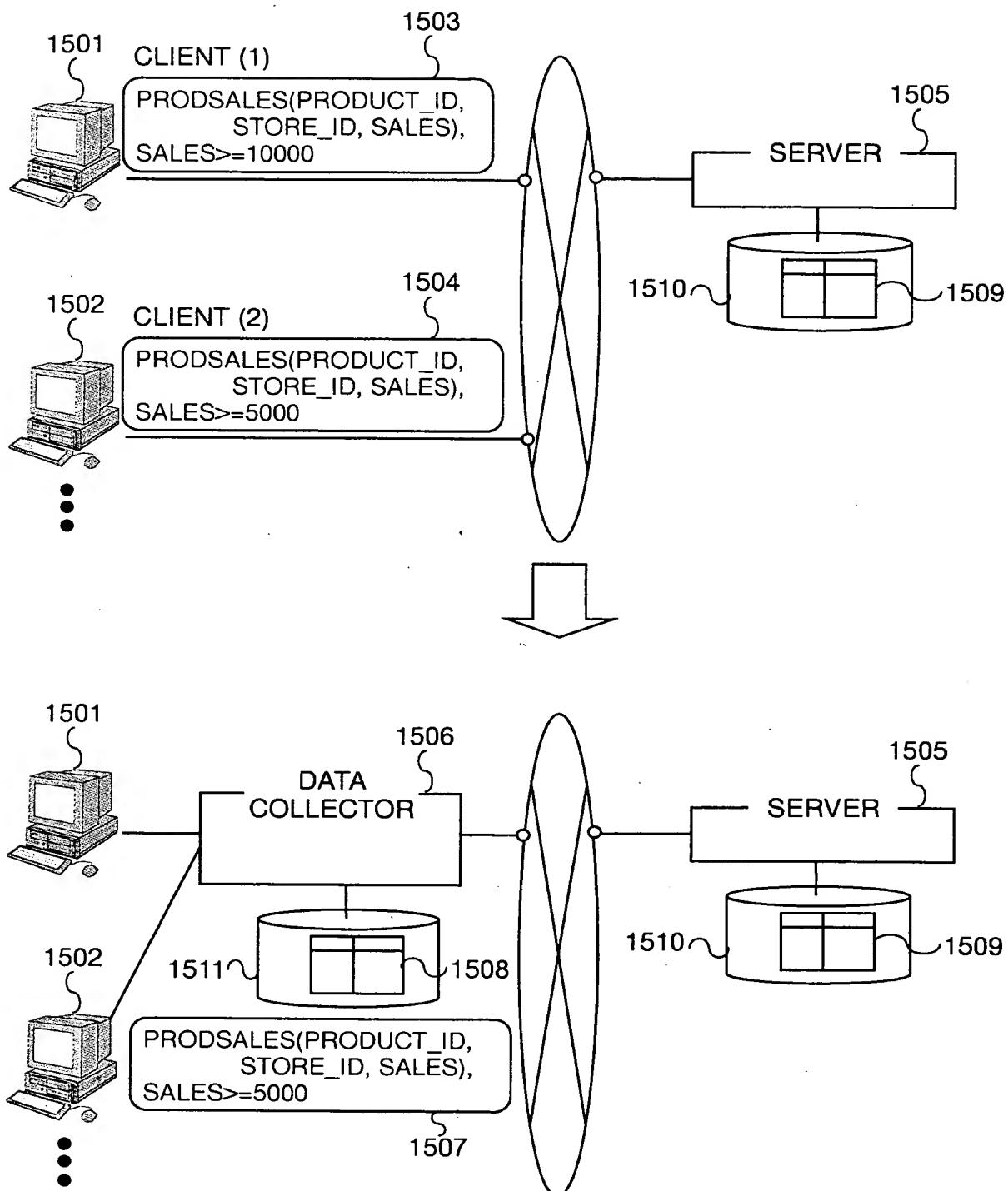


Fig. 16

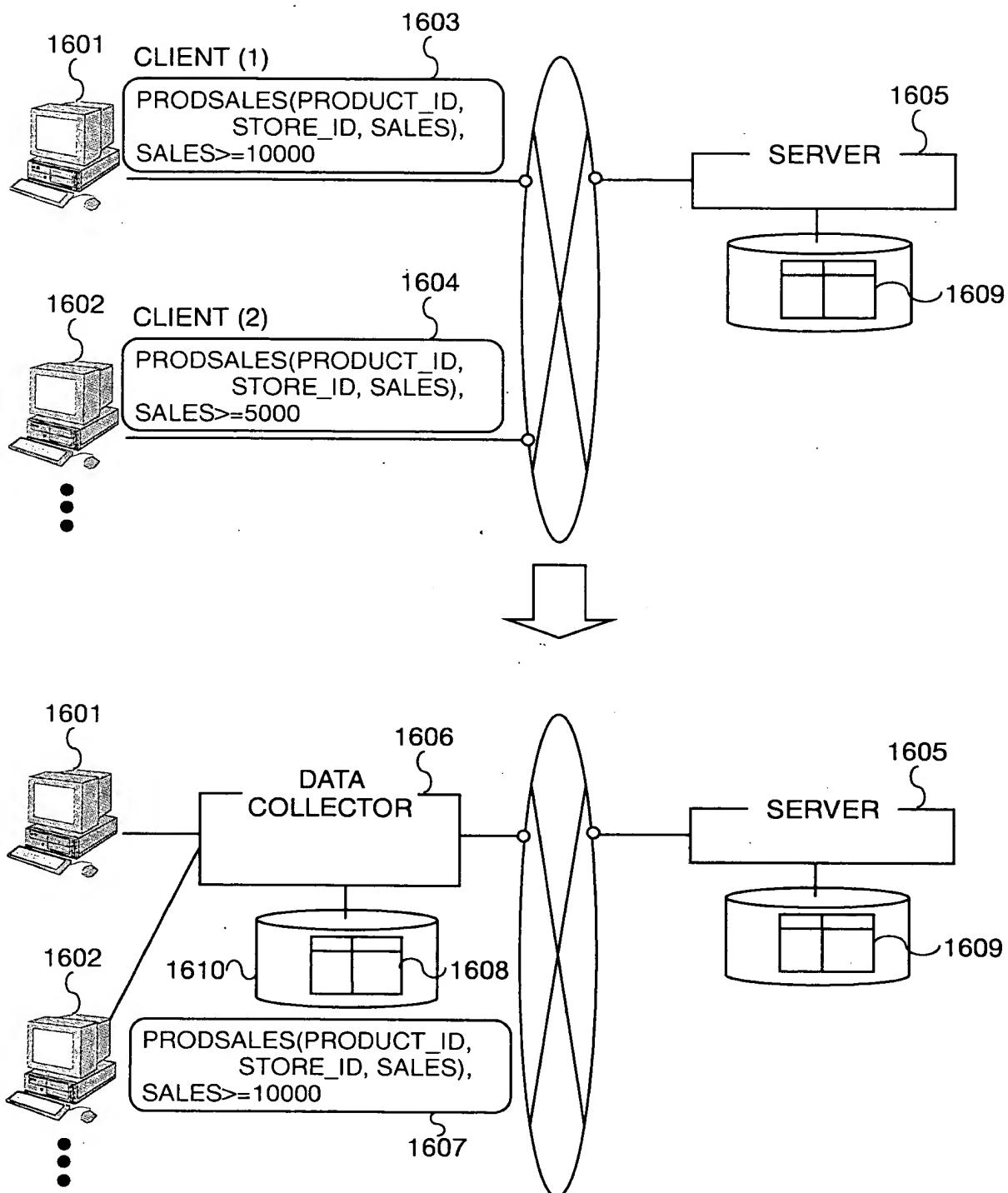
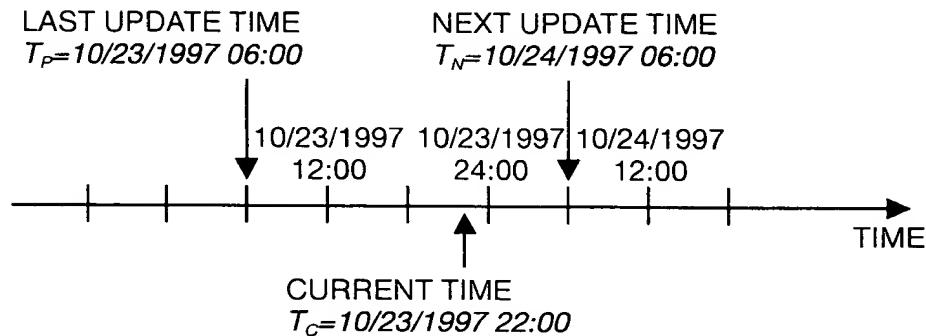


Fig. 17

DATA UPDATE FREQUENCY REDUCTION USING DATA FRESHNESS CONDITION



DATA FRESHNESS CONDITION:  $T_F = 1$  day  
 $d_A(T_C) = d_A(T_P) \quad (T_C - T_P < T_F)$

Fig. 19

DATA RANGE	DATA QUALITY	DELIVERY METHOD	
ORDER(ORDER_ID, PRICE, CUSTOMER_ID) PRICE >= 20000	-	ONCE BETWEEN 11:00 AND 15:00, PUSH	~ 1901
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE <= 2000	-	ONCE PER 1 DAY, PUSH	~ 1902
ORDER(ORDER_ID, PRICE, CUSTOMER_ID), PRICE <= 2000	SAMPLE(ORDER, ORDER_ID, 10%)	ONCE BETWEEN 21:00 AND 23:00, PULL	
SALESDETAIL(ORDER_ID, SHIPDATE, ORDER_AMOUNT), SHIPDATE >= 1990/01/01	TOP-N(SALESDETAIL, ORDER_AMOUNT, 100)	ONCE PER 1 HOUR, PULL	
...	...	...	

Fig. 18

